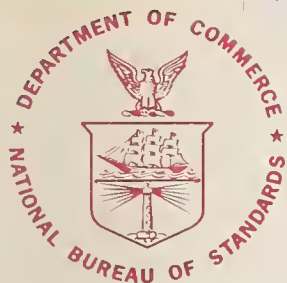


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SUPPLEMENT 3

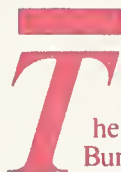
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Bibliography on Atomic Energy Levels and Spectra

July 1979 through December 1983

Arlene Musgrove and Romuald Zalubas

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Foreword

The National Standard Reference Data System was established in 1963 for the purpose of promoting the critical evaluation and dissemination of numerical data of the physical sciences. The program is coordinated by the Office of Standard Reference Data of the National Bureau of Standards but involves the efforts of many groups in universities, government laboratories, and private industry. The primary aim of the program is to provide compilations of critically evaluated physical and chemical property data. These tables are published in the *Journal of Physical and Chemical Reference Data*, in the NSRDS-NBS series of the National Bureau of Standards, and through other appropriate channels.

The task of critical evaluation is carried out in various data centers, each with a well-defined technical scope. A necessary preliminary step to the critical evaluation process is the retrieval from the world scientific literature of all papers falling within the scope of the center. Each center, therefore, builds up a comprehensive well-indexed bibliographical file which forms the base for the evaluation task. Bibliographies derived from these files are published when they appear to be of value to research workers and others interested in the particular technical area.

Further information on NSRDS and the publications which form the primary output of the program may be obtained by writing to the Office of Standard Reference Data, National Bureau of Standards, Gaithersburg, MD 20899.

DAVID R. LIDE, JR., *Director*
Standard Reference Data
National Bureau of Standards

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Bibliography on Atomic Energy Levels and Spectra July 1979 through December 1983

Arlene Musgrove and Romuald Zalubas

This is the third supplement to NBS Special Publication 363, *Bibliography on Atomic Energy Levels and Spectra, July 1968 through June 1971*. Supplement 1 covered the period from July 1971 through June 1975, Supplement 2 covered the period from July 1975 through June 1979, and this bibliography covers the literature from July 1979 through December 1983. It contains approximately 1200 references classified by subject for individual atoms and atomic ions. A number index identifies the references. An author index is included. References included contain data on energy levels, classified lines, wavelengths, Zeeman effect, Stark effect, hyperfine structure, isotope shift, ionization potentials, or theory which gives results for specific atoms or atomic ions.

Key words: Atomic energy levels; atomic spectra; bibliography; energy levels, atomic; spectra, atomic; wavelengths, atoms and ions.

1. Introduction

This is Supplement 3 for the publication *Bibliography on Atomic Energy Levels and Spectra* [1]¹ by the Atomic Energy Levels Data Center. We list references to new papers which have a publication date up to December 31, 1983 and were available to us as reprints or from the serial and book holdings of the NBS Library. Papers published by that date which were not yet available to us as of May 1984 will be included in Supplement 4. The format is the same as in previously published bibliographies.

1.1. Reference Classification Scheme and Scope of Bibliography

The references pertain to atomic structure and spectra that arise from interactions or excitations involving electrons in the outer shells of free atoms and atomic ions, or from inner shell excitations corresponding to frequencies up to the soft x-ray range. A paper was included if it gave results for a particular ion or spectrum falling into one of the following categories:

EL Energy Levels. Experimental energy differences, except Hfs or IS. Includes references that suggest the rejection of previously reported levels.

ND New Designations. New or changed designations or J values for known energy levels.

CL Classified Lines. Indicates the assignment of newly or previously observed lines to transitions between energy levels that are specified by theoretical designations and/or by their positions in a known level scheme.

TA Transition Array. Lines or groups of lines assigned to transition array(s) (but not to particular levels or terms).

W Wavelengths (or wavenumbers). New measurements, or wavelengths newly assigned to a particular spectrum. References that list measurements of other entities corresponding to energy differences between levels may also be included.

ZE Zeeman Effect data or interpretation.

SE Stark Effect data or interpretation.

Hfs Hyperfine Structure. Observations and theory.

IS Isotopic or Isomeric (Nuclear) Shifts.

QF Quantum Field effects. Lamb shifts, experimental and theoretical results.

IP Ionization Potential.

SF Series Formulae. Evaluated series constants.

TE Theoretical Energies. Restricted to a few references that give calculated energy levels with accuracies about equal to or exceeding those now obtainable by observation.

¹ Figures in brackets refer to literature references in section 1.3

PT Parametric Theory. Evaluations of the usual energy parameters of Slater-Condon theory, or extensions thereof, based on fitting the theory to experimental levels, g -factors and/or other observed quantities.

AT Ab initio Theory. These references are mostly to Hartree-Fock type calculations of energy parameters or levels.

In section 2.2 the above categories are arranged alphabetically.

References to atomic energy levels and spectra determined from solution or crystal data have category symbols enclosed in parentheses.

It is worth noting that this bibliography does not contain references to atomic transition probabilities, line intensities, or broadening. The NBS Data Center on Atomic Transition Probabilities and Atomic Line Shapes and Shifts publishes bibliographies on these subjects [2].

This bibliography is further restricted, with few exceptions, to original research papers or monographs. Textbooks, extensive compilations of special interest, and other selected publications that are not included in the classified references are given at the end of this introduction in section 1.4.

1.2. Arrangement of Bibliography and Handling of Special Types of References

Each reference has been assigned a number. In section 2.2 the appropriate reference numbers are given under headings for individual spectra (element and ionization stage). The reference numbers under each spectrum heading are listed separately for each of the content categories explained above. Reference numbers for papers reporting wavelengths of unknown ionization stage are given as the first group for the element.

The full references are given in order of the assigned numbers in section 3. Each such reference is followed by the spectra and category symbols appropriate to the content. Except for Russian titles, which are given in English, the titles of articles are given in the language in which they were published. References to articles from Russian journals that also appear in English translations are to the translation journals.

Section 2.1 is an index to the spectra for which there are references; an author index (sec. 4) follows the listing of the complete references.

The main exception from the arrangement described above is for the references 6050T through 6089T. Each of these papers gives theoretical results for a rather large number of elements and/or ionization stages and

their numbers are followed by a "T" to indicate that the papers give theoretical results only. These references are included in section 3, along with the usual information on their content, and in the author index. However, they were omitted from the reference numbers for the individual spectra (sec. 2.2).

Most of the reference numbers followed by an "A" indicate abstracts of theses in Dissertation Abstracts. Some of the other references are to theses for which the AEL Data Center has obtained copies. The assigned content categories for these abstracts are those thought to be applicable to the paper itself, as indicated by the abstract; the indicated results are not necessarily included in the abstracts. These abstracts frequently provide information about work in progress.

References to lanthanide and actinide atomic energy levels and spectra determined from solution or crystal data are included for atoms and atomic ions for which these data have not been determined for the free gaseous atom or ion. For these references, the reference classification categories which apply are enclosed in parentheses to differentiate them from articles to atomic energy levels and spectra of free gaseous atoms and atomic ions.

The abbreviations of periodical titles generally follow the style given in *Bibliographic Guide for Editors and Authors* [3].

We are grateful to Drs. W. C. Martin and J. Sugar for many valuable consultations during the preparation of this bibliography. We appreciate the assistance of Deirdre Thompson and Deana Ramsburg in obtaining and inputting pertinent references for inclusion into this publication. We thank the Data Systems Development Group of the Office of Standard Reference Data for their skills involved with creating the author and individual spectra indexes directly from each separate bibliographic entry and for placing these indexes and individual references into a computer-readable form for automatic typesetting.

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2. Classified References for Individual Spectra

2.1. Index to Spectra

Element	Z	Spectrum	Page	Element	Z	Spectrum	Page		
Aluminum	13	Al I	16	Barium-Continued		Ba XXVIII	34		
		Al II				Ba XXX			
		Al III		Berkelium	97	Bk I	40		
		Al IV				Bk II			
		Al V							
		Al VI		Beryllium	4	Be I	13		
		Al VII				Be II			
		Al VIII				Be III			
		Al IX				Be IV			
		Al X		Bismuth	83	Bi I	39		
		Al XI				Bi II			
		Al XII				Bi III			
		Al XIII							
Antimony	51	Sb I	32	Boron	5	B I	13		
		Sb II				B II			
		Sb VI				B III			
		Sb VII				B V			
		Sb XXIII							
Argon	18	Ar I	18	Bromine	35	Br I	26		
		Ar II				Br VII			
		Ar III				Br VIII			
		Ar IV				Br IX			
		Ar VI				Br XXIV			
		Ar VII				Br XXV			
		Ar VIII				Br XXVI			
		Ar IX				Br XXVII			
		Ar X				Br XXVIII			
		Ar XI				Br XXXII			
		Ar XII		Cadmium	48	Cd I	31		
		Ar XIII				Cd II	32		
		Ar XIV				Cd III			
		Ar XV				Cd IV			
		Ar XVI				Cd V			
		Ar XVII				Cd XX			
		Ar XVIII				Cd XXXIX			
Ar XVIII	Cd XLV								
Arsenic	33	As I	25	Calcium	20	Ca	19		
		As IV				Ca I			
		As V	26			Ca II			
		As VI				Ca III			
		As VII				Ca IV			
		As XVII				Ca VIII			
		As XX				Ca IX			
		As XXI				Ca XI			
		As XXII				Ca XII			
		As XXIII				Ca XIII			
		As XXIV				Ca XIV			
		As XXV				Ca XV			
		As XXVI				Ca XVI			
Barium	56	Ba I	34	Californium	98	Ca XVII	40		
		Ba II				Ca XVIII			
		Ba III				Ca XIX			
		Ba V				Ca XX			
		Ba X				Cf I			
		Ba XI				Cf II			
		Ba XII							
		Ba XXVII							

2.1. Index to Spectra—Continued

Element	Z	Spectrum	Page	Element	Z	Spectrum	Page						
Carbon	6	C I	14	Cobalt	27	Co I	23						
		C II				Co II							
		C III				Co VII							
		C IV				Co VIII							
		C V				Co IX							
		C VI				Co XI							
Cerium	58	Ce III	35			Co XII							
		Ce VIII				Co XIII							
		Ce IX				Co XIV							
		Ce X				Co XV							
		Ce XI				Co XVI							
		Ce XII				Co XVII							
		Ce XIII				Co XVIII							
		Ce XIV				Co XIX							
		Ce XV				Co XX							
Cesium	55	Cs I	34			Co XXI							
		Cs II				Co XXII							
		Cs III				Co XXIII							
		Cs IV				Co XXIV							
		Cs IX				Co XXV							
		Cs X				Co XXVI							
Chlorine	17	Cl I	17			Copper		29	Cu	24			
		Cl II							Cu I				
		Cl III							Cu II				
		Cl IV		Cu IV									
		Cl V		Cu VI									
		Cl VI		Cu X									
		Cl VII		Cu XI									
		Cl VIII		Cu XIII									
	18	Cl IX	Cu XIV										
		Cl X	Cu XV										
		Cl XI	Cu XVI										
		Cl XII	Cu XVII										
		Cl XIII	Cu XVIII										
		Cl XV	Cu XX										
		Cl XVI	Cu XXI										
		Cl XVII	Cu XXII										
Chromium	24	Cr I	21	Curium	96		Cm I		40				
		Cr II					Cm II						
		Cr III					Dysprosium				66	Dy I	36
		Cr IV										Dy II	
		Cr V		Dy XX									
		Cr XIII		Dy XXI									
		Cr XIV		Dy XXXVII									
		Cr XV		Dy XXXVIII									
		Cr XVI		Dy XXXIX									
		Cr XVII		Dy XL									
		Cr XVIII		Einsteinium	99	Es I		40					
		Cr XIX				Es II							
		Cr XX				Erbium	68		Er I	36			
		Cr XXI							Er III				
Cr XXII	Er IV	37											
Cr XXIII													

2.1. Index to Spectra—Continued

Element	Z	Spectrum	Page	Element	Z	Spectrum	Page
Erbium—Continued		Er XXXIX	37	Gold	79	Au I	38
		Er XL				Au II	
		Er XLII				Au XIX	39
						Au LI	
Europium	63	Eu I	36	Hafnium	72	Hf I	37
		Eu II				Hf IV	
		Eu III				Hf V	
		Eu XVII				Hf XLIII	
		Eu XVIII				Hf XLIV	
						Hf XLV	
Fluorine	9	F I	14			Hf XLVI	
		F V		Helium	2	He ⁺	13
		F VI				He I	
		F VII				He II	
		F VIII					
		F IX					
Francium	87	Fr	39	Holmium	67	Ho I	36
		Fr I				Ho XXI	
						Ho XXII	
						Ho XXXIX	
Gadolinium	64	Gd I	36	Hydrogen	1	H ⁺	13
		Gd II				H I	
		Gd XII					
		Gd XVIII		Indium	49	In I	32
		Gd XIX				In II	
		Gd XXXV				In IV	
		Gd XXXVI				In VI	
		Gd XXXVII				In XXI	
		Gd XXXVIII				In XL	
		Gd LXI					
Gallium	31	Ga	25	Iodine	53	I I	33
		Ga I				I II	
		Ga II				I VI	
		Ga VI				I VII	
		Ga XV				I VIII	
		Ga XVI				I IX	
		Ga XIX				I XXV	
		Ga XX					
		Ga XXI		Iridium	77	Ir I	38
		Ga XXII				Ir XVII	
		Ga XXIII				Ir XLIX	
		Ga XXIV					
		Ga XXX		Iron	26	Fe I	22
						Fe II	
Germanium	32	Ge IV	25			Fe V	
		Ge VI				Fe VI	
		Ge VII				Fe VII	
		Ge XIV				Fe VIII	
		Ge XV				Fe IX	
		Ge XVI				Fe X	
		Ge XVII				Fe XI	
		Ge XVIII				Fe XII	
		Ge XIX				Fe XIII	
		Ge XX				Fe XIV	
		Ge XXI				Fe XV	
		Ge XXII				Fe XVI	
		Ge XXIII				Fe XVII	
		Ge XXIV				Fe XVIII	
		Ge XXV				Fe XIX	
		Ge XXVI				Fe XX	
		Ge XXVII					

2.1. Index to Spectra – Continued

Element	Z	Spectrum	Page	Element	Z	Spectrum	Page
Iron-Continued		Fe XXI	22	Lutetium	71	Lu I	37
		Fe XXII				Lu II	
		Fe XXIII				Lu III	
		Fe XXIV				Lu IV	
		Fe XXV	23	Magnesium	12	Mg I	15
		Fe XXVI				Mg II	
Krypton	36	Kr I	26			Mg III	
		Kr II				Mg IV	
		Kr III				Mg V	
		Kr IV	27			Mg VI	
		Kr V				Mg VII	
		Kr VIII				Mg VIII	
		Kr IX				Mg IX	
		Kr X				Mg X	
		Kr XI				Mg XI	
		Kr XII				Mg XII	
		Kr XIII		Manganese	25	Mn I	21
		Kr XIV				Mn II	
		Kr XX				Mn VI	
		Kr XXI				Mn VII	
		Kr XXIII				Mn VIII	
		Kr XXIV				Mn IX	
		Kr XXV				Mn X	
		Kr XXVI				Mn XI	
		Kr XXVII				Mn XII	
		Kr XXVIII				Mn XIII	
		Kr XXIX				Mn XIV	22
		Kr XXX				Mn XV	
		Kr XXXI				Mn XVI	
		Kr XXXII				Mn XVII	
		Kr XXXIII				Mn XVIII	
		Kr XXXIV				Mn XIX	
		Kr XXXV				Mn XX	
Lanthanum	57	La I	34	Mercury	80	Hg I	39
		La II				Hg II	
		La VI	35			Hg LII	
		La XI				Hg LXXIII	
		La XII		Molybdenum	42	Mo I	30
		La XXVIII				Mo VI	
		La XXXI				Mo VIII	
		La XXXIX				Mo X	
Lawrencium	103	Lr I	40			Mo XII	
						Mo XIII	
Lead	82	Pb I	39			Mo XIV	
		Pb II				Mo XV	
		Pb XXI				Mo XVI	
		Pb XXII				Mo XVII	
		Pb LIV				Mo XVIII	
		Pb LXXIX				Mo XIX	
Lithium	3	Li	13			Mo XX	
		Li ⁻				Mo XXI	
		Li I				Mo XXII	
		Li II				Mo XXIII	
		Li III				Mo XXIV	
						Mo XXVI	
						Mo XXVII	
						Mo XXVIII	
						Mc XXIX	
						Mo XXX	
						Mo XXXI	
						Mo XXXII	

2.1. Index to Spectra—Continued

Element	Z	Spectrum	Page	Element	Z	Spectrum	Page			
Molybdenum-Continued		Mo XXXIII	30	Niobium-Continued		Nb VII	29			
		Mo XXXIV				Nb IX				
		Mo XXXV				Nb XII				
		Mo XXXIX				Nb XIII				
Neodymium	60	Nd I	35			Nb XIV				
		Nd II				Nb XV				
		Nd IV				Nb XVI				
		Nd XIV				Nb XVII				
		Nd XV				Nb XXV				
		Nd XXXI				Nb XXIX				
		Nd XXXII				Nb XXX				
		Nd XXXIV				Nb XXXIII				
Neon	10	Ne I	14 15			Nitrogen		7	Nb XXXIV	14
		Ne II							Nb XXXIX	
		Ne III		Nb XL						
		Ne IV		N I						
		Ne V		N II						
		Ne VI		N III						
		Ne VII		N IV						
		Ne VIII		N V						
		Ne IX		N VI						
		Ne X		N VII						
Neptunium	93	Np I	40	Osmium	76	Os XLVIII	38			
		Np II		Oxygen	8	O I	14			
		Np III				O III				
		Np IV				O IV				
		Np V				O V				
		Np VI				O VI				
Nickel	28	Ni I	23 <							

2.1. Index to Spectra—Continued

Element	Z	Spectrum	Page	Element	Z	Spectrum	Page		
Plutonium	94	Pu I	40	Samarium	62	Sm I	35		
		Pu II				Sm II			
		Pu III				Sm XVI			
		Pu IV				Sm XVII			
		Pu V				Sm XXXIII			
		Pu VI				Sm XXXIV			
Potassium	19	K I	18	Scandium	21	Sm XXXV			
		K II				Sm XXXVI			
		K III				Sc I	19		
		K VIII				Sc II			
		K X				Sc X			
		K XI	Sc XII						
		K XII	Sc XIII						
		K XIII	Sc XIV						
		K XIV	Sc XV						
		K XV	Sc XVI			20			
		K XVI	Sc XVII						
		K XVII	Sc XVIII						
		K XIX	Sc XIX			26			
Praseodymium	59	Pr I	35	Selenium	34		Se I		
		Pr IV					Se V		
		Pr XIII					Se VI		
		Pr XIV					Se XVI		
Promethium	61	Pm XVI	35				Se XVII		
Radium	88	Ra I	39				Se XVIII		
							Se XIX		
Rhenium	75	Re I	38				Se XX		
		Re XLVI					Se XXI		
		Re XLVII					Se XXII		
		Re XLVIII					Se XXIII		
		Re XLIX					Se XXIV		
Rhodium	45	Rh XVII	31			Silicon	14	Se XXV	16
		Rh XVIII		Se XXVI					
		Rh XIX		Se XXVII					
		Rh XX		Si I					
		Rh XXI		Si II					
		Rh XXIV		Si III					
Rubidium	37	Rb I	27	Si IV					
		Rb II		Si V					
		Rb IX		Si VI					
		Rb XII		Si VII					
		Rb XXVI		Si VIII					
		Rb XXVIII		Si IX					
		Rb XXIX		Si X					
		Rb XXXVI		Si XI					
Ruthenium	44	Ru I	30	Silver	47	Si XII	31		
		Ru XVI				Si XIII			
		Ru XVII				Si XIV			
		Ru XVIII				Ag I			
		Ru XIX				Ag II			
		Ru XX				Ag IV			
		Ru XXXIII				Ag XVII			
		Ru XLI				Ag XVIII			
	Ag XIX								
	Ag XX								
	Ag XXI								
	Ag XXII								
	Ag XXIII								
	Ag XXXVIII								

2.1. Index to Spectra – Continued

Element	Z	Spectrum	Page	Element	Z	Spectrum	Page
Sodium	11	Na I	15	Thorium	90	Th I	39
		Na II				Th II	
		Na IV				Th III	
		Na X				Th VIII	
		Na XI				Th IX	
Strontium	38	Sr I	27			Th X	
		Sr II				Th XI	
		Sr IX				Th XII	
		Sr X				Th XIII	
		Sr XI				Th XIV	
		Sr XII				Th XV	
		Sr XIII	28	Th XVI			
		Sr XIV		Thulium	69	Tm I	37
		Sr XXII				Tm IV	
		Sr XXIII				Tm XL	
		Sr XXVI				Tm XLI	
		Sr XXVII				Tm XLII	
		Sr XXIX				Tm XLIII	
		Sr XXX				Tm XLIV	
Sulfur	16	S I	17			Tin	
		S II		Sn II			
		S III		Sn V			
		S IV		Sn XX			
		S V		Sn XXI			
		S VI		Sn XXII			
		S VII		Sn XLI			
		S IX		Titanium	22	Ti I	20
		S X				Ti II	
		S XIV				Ti III	
		S XV				Ti IV	
		S XVI				Ti V	
Tantalum	73	Ta I	38	Ti X			
		Ta VI		Ti XI			
		Ta XLIV		Ti XII			
		Ta XLV		Ti XIII			
		Ta XLVI		Ti XIV			
		Ta XLVII		Ti XV			
Technetium	43	Tc I	30	Ti XVI			
		Tc XV		Ti XVII			
		Tc XXXII		Ti XVIII			
Tellurium	52	Te I	32	Ti XIX			
		Te II		33	Ti XX		
		Te VII		Tungsten	74	Ti XXI	
		Te VIII				W VII	
		Te XXIV				W XIII	
Terbium	65	Tb III	36	W XIV			
		Tb XIX		W XXVIII			
		Tb XX		W XLV			
Thallium	81	Tl	39	W XLVI			
		Tl I		W XLVII			
		Tl II		W XLVIII			
		Tl LIII		W LXXI			
Uranium	92	U I	39				
		U II		40			
		U III					
		U IV					

2.1. Index to Spectra—Continued

Element	Z	Spectrum	Page	Element	Z	Spectrum	Page
Uranium-Continued		U v U VI U XXXII U LXIV U LXXXIX	40	Yttrium-Continued		Y x Y XI Y XII Y XIII Y XIV Y XV Y XXVIII Y XXX Y XXXI Y XXXVII	28
Vanadium	23	V I V II V III V IV V V V VII V VIII V IX V X V XII V XIV V XV V XVI V XVII V XVIII V XIX V XX V XXI V XXII	20 21	Zinc	30	Zn I Zn II Zn V Zn XIV Zn XVIII Zn XIX Zn XX Zn XXI Zn XXII Zn XXIII Zn XXIV Zn XXVII Zn XXIX	24 25
Xenon	54	Xe I Xe II Xe III Xe IV Xe VI Xe VII Xe VIII Xe IX Xe X Xe XVII Xe XXV Xe XXVI Xe XXVIII Xe XLIV Xe XLV Xe XLVI Xe XLVII Xe LI	33 34	Zirconium	40	Zr I Zr III Zr IV Zr V Zr VI Zr VII Zr VIII Zr IX Zr XI Zr XII Zr XIII Zr XIV Zr XV Zr XVI Zr XXI Zr XXII Zr XXIV Zr XXV Zr XXVI Zr XXVII Zr XXVIII Zr XXIX Zr XXXI Zr XXXII Zr XXXIII	28 29
Ytterbium	70	Yb I Yb II Yb XLI Yb XLII Yb XLIII Yb XLIV	37				
Yttrium	39	Y I Y IV Y V Y VII	28				

2.2. Reference Numbers for Individual Spectra

Hydrogen			Li I-Continued		
H ⁻	AT	4950, 4992	CL	5261, 5607, 5608, 5751, 5982A	
	CL	5238	EL	4964, 5017, 5347, 5751	
H I	CL	4937	Hfs	5080	
	EL	4937, 5036, 5183, 5225, 5663	IP	5401, 5783	
	IP	5444	IS	5033, 5811	
	QF	5065, 5098, 5127, 5481, 5934	ND	5608	
		5955	PT	5367	
	SE	4902, 5610, 5890	SE	4976	
	SF	5444	TA	5041, 5777	
	TA	4860, 5780			
	ZE	5631, 5890			
Helium			Li II		
He ⁻	AT	5153, 5163, 5200, 5264	AT	4950, 5304, 5912, 5940, 5687	
He I	AT	4950, 4992, 5075, 5199, 5353	CL	5612, 5778, 5982A	
		5506, 5528, 5549, 5588, 5591	EL	4923, 4964, 5092, 5778	
		5742, 5860, 5867, 5940	Hfs	4870, 4923, 4929, 5092, 5094	
	CL	4939, 4962, 5009, 5161, 5170		5351, 5387, 5684, 5876, 5922A	
		5182, 5502, 5612, 5690, 5741	IS	4923, 5351, 5687	
		5806, 5814	PT	5367	
	EL	4939, 4961, 4962, 4999, 5084	QF	5092	
		5088, 5101, 5161, 5182, 5201			
		5202, 5344, 5353, 5366, 5446			
		5460, 5546, 5597, 5690, 5741			
		5758, 5793, 5814, 5960A			
	Hfs	5089, 5099A, 5202, 5259, 5377			
		5447, 5585, 5597, 5615, 5648			
		5649, 5650, 5651, 5795, 5865A			
	IS	4942, 5099A, 5202, 5350, 5465			
		5649, 5693, 5814, 5867, 5960A			
	ND	4990			
	PT	4939, 5182, 5502			
	QF	5546, 5740			
	SF	5496			
	W	5546			
Lithium			Li III		
Li	CL	5001	CL	5778	
	EL	5001	EL	5095, 5778	
Li ⁻	AT	5164, 5165, 5686	Hfs	5095	
	CL	5160, 5244	IP	5444	
Li I	AT	4872, 4982, 4986, 5012, 5049	SF	5444	
		5153, 5230, 5241, 5262, 5275			
		5358, 5373, 5492, 5526, 5549			
		5551, 5767, 5776, 5805, 5828			
		5829			
			Beryllium		
Be I	AT	4903, 5074, 5686, 5846, 5961			
	EL	4964			
	IP	5964			
Be II	AT	4924, 4941, 5012, 5230, 5275			
		5526, 5565, 5589, 5669, 5776			
		5846, 5950			
	CL	5311, 5405, 5406, 5703			
	EL	4964, 5236, 5703			
	ND	5445			
	PT	5367			
	TA	5971			
Be III	AT	5576, 5867, 5940			
	CL	5078, 5311			
	EL	4964, 5078			
	IS	5867			
	TA	5971			
Be IV	IP	5444			
	SF	5444			
			Boron		
B I	AT	4968, 5265, 5310			
	EL	4964			
B II	EL	4964			
B III	AT	4941, 5012, 5230, 5275, 5468			
		5776			
B V	IP	5444			
	SF	5444			

2.2. Reference Numbers for Individual Spectra—Continued

Carbon			Oxygen		
C I	AT	5310, 5388, 5457, 5646, 5664	O I	AT	5058, 5274, 5310, 5412, 5903A
	CL	5263, 5455, 5681		EL	4969, 5315
	EL	4964, 5125, 5263, 5388, 5455		ZE	4969
	IS	4928, 5936			
C II	AT	5265, 5294, 5388, 5456, 5944	O III	AT	4858, 4921, 5254, 5255, 5386
	CL	5034		CL	5596
	EL	4964, 5388		EL	5596
	IP	5456		IP	5596
	IS	5916A			
C III	AT	5053, 5388, 5407, 5423, 5443	O IV	AT	5265, 5456, 5736
		5732		CL	5114
	CL	5034, 5407, 5612		IP	5456
C IV	EL	4964, 5388, 5407	O V	AT	4984, 5053, 5060, 5091, 5270
	AT	5230, 5275, 5776, 5878			5407, 5424, 5732
	CL	5171		CL	5379, 5407, 5612, 5837
EL	4964	EL		5035, 5379, 5407	
C V			IP	5035	
	AT	5878	O VI	AT	4872, 5195
	CL	5171		CL	5114, 5162, 5837
EL	4964				
C VI	IP	5444	O VII	AT	5146, 5404
	SF	5444		CL	4881, 5114, 5530, 5837
				EL	4881
		IP		5114	
		QF		4881	
			O VIII	IP	5444
		QF		5619	
		SF		5444	
			Fluorine		
N I	AT	5197, 5786	F I	AT	5310
	CL	5166, 5681, 5897		EL	5189
	EL	5417		Hfs	5746
	Hfs	5417	F V	CL	5602
	PT	5327, 5417			
W	5180				
N II	AT	5457	F VI	AT	5053, 5060, 5732
	CL	5939		CL	5602, 5752
	EL	5939		EL	5752
	Hfs	4973		W	4869, 5752
	IP	5939	F VII	CL	5602, 5752, 5837
N III	AT	5265, 5456		EL	5752
	CL	5155		W	5752
	EL	5155			
	IP	5456	F VIII	CL	5530, 5602, 5837
N IV	AT	5053, 5060, 5407, 5508, 5563		EL	5319
		5732, 5961		Hfs	5319
	CL	5407, 5612			
EL	5407	F IX	CL	5602	
N V	AT		5949	IP	5444
			SF	5444	
N VI	CL	5834			
	EL	5834			
	SF	5834			
N VII	IP	5444			
	SF	5444			
			Neon		
Ne I	AT	4953, 4955, 4981, 5176, 5211	Ne I	AT	4953, 4955, 4981, 5176, 5211
		5500, 5759, 5812, 5903A			5500, 5759, 5812, 5903A
	CL	4934, 4963, 5401, 5642, 5725		CL	4934, 4963, 5401, 5642, 5725
		5803, 5935, 5960A			5803, 5935, 5960A

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Ne I—Continued

EL	4875, 4877, 4934, 4983, 5273 5290, 5305, 5725, 5855, 5935
Hfs	4857, 5219
IP	5401
IS	4875, 5219, 5331, 5769, 5873
TA	5154
ZE	4931, 4967, 5522

Ne II	AT	4898, 5066, 5418, 5419, 5812 5882
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EL	4983, 5882
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Ne III	AT	4898, 5490
	CL	5945
	EL	5305, 5859
	W	5709

Ne IV	AT	4874, 4898, 5490
	ND	4874

Ne V	AT	4874, 4898, 5490
	W	5709

Ne VI	AT	5490
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Ne VII	AT	5053, 5060, 5269, 5299, 5732 5961
	TA	5853

Ne VIII	TA	5853
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Ne IX	AT	5867, 5940
	CL	5626
	EL	5626
	IS	5867
	TA	5853

Ne X	IP	5444
	SF	5444

Sodium

Na I	AT	5049, 5050, 5188, 5467, 5551
	CL	5029, 5216, 5279, 5689, 5726 5824, 5869, 5918
	EL	4888, 4946, 4994, 5029, 5216 5279, 5313, 5689, 5726, 5824
	Hfs	4878, 4949, 4954, 4993, 5151A 5569, 5682, 5726, 5768
	IP	5783
	IS	4954, 5569, 5670, 5768
	ND	5869
	PT	5677
	SE	4976, 5503
	SF	5057
	TA	4888
	W	5014
	ZE	5383

Na II	AT	4988, 5032
	EL	5209

Na IV	PT	5131
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Na X	CL	5243
	SF	5453

Na XI	CL	5243
	IP	5444
	SF	5444

Magnesium

Mg I	AT	5028, 5051, 5720
	CL	5123, 5152, 5559, 5914
	EL	5123, 5402, 5559
	IP	5827, 5964
	IS	5899
	SF	5402, 5827

Mg II	AT	5050, 5467
	CL	5152
	Hfs	5372
	ZE	5372

Mg III	AT	5475, 5759
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Mg IV	AT	5475
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Mg V	AT	5475, 5903A
	CL	5142, 5278
	EL	5142
	ND	5142
	PT	5142
	W	5071

Mg VI	AT	5044, 5475
	CL	5945
	W	5071

Mg VII	AT	5475
	CL	5316
	W	5071

Mg VIII	AT	5475
	CL	5511
	EL	5381
	W	5071

Mg IX	AT	5018, 5422, 5475
	CL	5112
	W	5071, 5112

Mg X	AT	5314
	CL	4908, 5112, 5314, 5679
	EL	4908, 5314, 5679
	PT	5068
	W	4908, 5071, 5112

Mg XI	CL	5112, 5879
	SF	5453
	W	5071, 5112

Mg XII	AT	4936
	IP	5444
	SF	5444

2.2. Reference Numbers for Individual Spectra—Continued

Aluminum		
Al I	AT	5194, 5266, 5493
	CL	5493
	EL	5493
	Hfs	4913, 5592
	PT	5266, 5895
	TA	5491
	W	5491
	ZE	5194
Al II	AT	5028, 5051
	IP	5827
	SF	5827
Al III	AT	5050
Al IV	AT	5475
Al V	AT	5475
	CL	5511
Al VI	AT	5475
	CL	5131, 5511
	EL	5131
	PT	5052, 5131
Al VII	AT	5475
	CL	5659
Al VIII	AT	5475
	CL	5511
Al IX	AT	5475
	CL	5511, 5659, 5892
Al X	AT	5475
	CL	5112, 5659, 5892
	W	5112
Al XI	AT	4863, 5314
	CL	4863, 4908, 5112, 5314, 5879 5892
	EL	4863, 4908, 5314, 5892
	W	4908, 5112
Al XII	CL	5112, 5243, 5879
	EL	5237
	SF	5453
	W	5112
Al XIII	CL	5243
	IP	5444
	SF	5444
Silicon		
Si I	AT	5194, 5329
	PT	5895
	SE	5203
	ZE	5194

Si II	AT	5307, 5355
	CL	5307
	EL	5307
	PT	5895
	SE	5924
Si III	AT	5028, 5051
	IP	5827
	SF	5309, 5827
	W	5323
Si IV	AT	5050
Si V	AT	5475
Si VI	AT	5475
	CL	5511
Si VII	AT	4930, 5475, 5603
	CL	5511, 5683
	PT	5052
	W	5683
Si VIII	AT	5044, 5475, 5603
	CL	5072, 5683
	EL	5381
	W	4905, 5683
Si IX	AT	5475, 5603, 5635
	CL	4905, 5072, 5511, 5602, 5683
	EL	4905
	W	4905, 5683
Si X	AT	5475, 5603
	CL	4905, 5072, 5073, 5683
	EL	4905
	W	4905, 5683
Si XI	AT	5018, 5422, 5475, 5603, 5730
	CL	4905, 5602, 5683
	EL	4905
	W	4905, 5683
Si XII	AT	5195, 5314, 5603
	CL	4905, 5243, 5314, 5602, 5683
	EL	4905, 5314
	W	4905, 5683
Si XIII	AT	5416
	CL	4852, 4905, 4957, 5243, 5416 5542, 5602, 5613, 5683, 5879
	EL	4905, 4957, 5416
	QF	5416
	SF	5453
	W	5683
Si XIV	CL	5243, 5542
	IP	5444
	SF	5444
Phosphorus		
P I	AT	5148, 5194
	CL	5148, 5149

P I—Continued			S v	AT	5028, 5420, 5536
	EL	5148		CL	5337
	Hfs	5149		EL	5337
	IP	5148		IP	5337, 5827
	PT	5148		SF	5337, 5827
	W	5148			
	ZE	5194	S vi	CL	4882
P ii	CL	5779		EL	4882
	EL	5779		IP	4882
	IP	5779	S vii	CL	5875
	PT	5895		EL	5875
	SE	5747		PT	5875
P iii	AT	5357	S ix	AT	4930
P iv	AT	5028	S x	AT	5044
	IP	5827		PT	4867
	SF	5827	S xiv	AT	5314
P xi	AT	5314		CL	5220, 5314
	CL	5314		EL	5314
	EL	5314	S xv	AT	5416, 5525
P xii	AT	5314		CL	4957, 5220, 5416, 5525, 5542
	CL	5314			5613
	EL	5314		EL	4957, 5416, 5525
P xiii	AT	5314		QF	5416
	CL	5314, 5716		SF	5453
	EL	5314, 5716		TA	5831, 5833
P xiv	CL	5627, 5716, 5800, 5943A	S xvi	CL	5542
	EL	5627, 5716, 5943A		IP	5444
	SF	5453		SF	5444
P xv	IP	5444	Chlorine		
	QF	5757	Cl i	AT	5194, 5302, 5954
	SF	5444		CL	5681
Sulfur				IS	5086A, 5654
S i	AT	5058, 5194, 5302		TA	5764
	CL	5666		ZE	5194
	EL	5666	Cl ii	IS	5135
	IP	5666	Cl iii	CL	5611
	IS	5086A		EL	5611
	ZE	5194	Cl iv	CL	5611
S ii	AT	5816		EL	5611
	CL	5883	Cl v	CL	5611
	EL	5883		EL	5611
	IP	5883	Cl vi	AT	5028
	IS	5135		CL	5611
	PT	5883		EL	5611
S iii	AT	5214, 5816, 5842		IP	5827
	CL	5737		SF	5827
S iv	AT	4876, 5258	Cl vii	AT	5538
	EL	5079	Cl viii	CL	5625, 5973
	PT	5079		EL	5625, 5973
				PT	5625

2.2. Reference Numbers for Individual Spectra – Continued

Cl IX	AT	5515	Ar VIII	AT	5538
	CL	5515		CL	5617
	EL	5515	Ar IX	CL	5710, 5973
Cl X	AT	5515		EL	5710, 5973
	CL	5515		IP	5121
	EL	5515		TA	5853
Cl XI	AT	5579	Ar X	TA	5853
	CL	5579	Ar XI	AT	4930
	EL	5579		CL	5429
Cl XII	CL	5600		TA	5853
	EL	5600	Ar XII	AT	5044
Cl XIII	CL	5601		CL	5429
	EL	5601		TA	5853
Cl XV	AT	5314	Ar XIII	CL	5429
	CL	5314	Ar XIV	CL	5429
	EL	5314	Ar XV	AT	5018, 5422
Cl XVI	AT	5416		CL	5217, 5429
	CL	4957, 5198, 5416, 5613		EL	5217
	EL	4957, 5198, 5416	Ar XVI	AT	4863, 5314, 5901
	QF	5416		CL	4863, 5217, 5901
	SF	5453		EL	4863, 5217, 5314
	TA	5831, 5833	Ar XVII	AT	5901
Cl XVII	IP	5444		CL	5542, 5901, 5905
	QF	5539		EL	5905
	SF	5444		SF	5453
				TA	5832
Argon					
Ar I	AT	5523, 5661, 5759, 5903A	Ar XVIII	AT	5901
	CL	5401, 5642		CL	5901
	EL	5186, 5222, 5855		IP	5444
	IP	5401		QF	5905, 5915
	IS	5086A		SF	5444
	SE	5128	Potassium		
	ZE	5522, 5787	K I	AT	5049, 5551
Ar II	AT	5066, 5418, 5419, 5476, 5661		CL	5770, 5783
		5954		EL	5345, 5451, 5770, 5783
	CL	5790, 5807		Hfs	5027, 5484, 5620, 5634, 5718
	EL	5807			5768
	IS	5135		IP	5451, 5770, 5783
	SE	5240, 5431		IS	5179, 5484, 5634, 5768
Ar III	AT	5661		SE	4976
	EL	5859		SF	5451
Ar IV	AT	5661	K II	EL	5061, 5209
Ar VI	CL	5617	K III	AT	5954
	EL	4989	K VIII	IP	5827
Ar VII	AT	5028		SF	5827
	CL	5283, 5617	K X	AT	5485
	IP	5827		CL	5973
	SF	5827		EL	5973

2.2. Reference Numbers for Individual Spectra – Continued

K XI AT 5515
 CL 5515
 EL 5515

K XII AT 5515
 CL 5515
 EL 5515

K XIII AT 5579
 CL 5217, 5579
 EL 5217, 5579

K XIV CL 5217, 5600
 EL 5217, 5600

K XV CL 5217, 5601
 EL 5217, 5601

K XVI AT 5961
 CL 5217
 EL 5217

K XVII AT 5314
 CL 5217, 5314
 EL 5217, 5314

K XIX IP 5444
 SF 5444

Calcium

Ca W 5449

Ca I AT 5134, 5181, 5365, 5486, 5633
 CL 4910, 5134, 5301, 5463, 5486
 5803, 5854, 5894
 EL 4910, 5134, 5301, 5463, 5486
 5578, 5894
 Hfs 5348, 5479, 5518, 5695
 IP 5280
 IS 5483, 5695, 5817, 5894, 5926
 PT 4909, 4910, 5365, 5894
 SE 5894
 SF 5857
 W 5391, 5392, 5463

Ca II AT 5907
 CL 5854
 PT 4991

Ca III TA 5893

Ca IV CL 5511

Ca VIII CL 5511

Ca IX IP 5827
 SF 5827

Ca XI CL 5973
 EL 5973

Ca XII AT 5515
 CL 5515
 EL 5515

Ca XIII AT 5515
 CL 5515
 EL 5515

Ca XIV AT 5044, 5579, 5652
 CL 5217, 5316, 5579
 EL 5217, 5579

Ca XV CL 5217, 5316, 5600
 EL 5217, 5600

Ca XVI CL 5217, 5601
 EL 5217, 5601

Ca XVII AT 5018, 5422, 5961
 CL 5217
 EL 5217

Ca XVIII AT 5314, 5660
 CL 5217, 5314
 EL 5217, 5314

Ca XIX CL 5542, 5943A
 EL 5943A

Ca XX IP 5444
 SF 5444

Scandium

Sc I Hfs 5464

Sc II AT 5425
 CL 5141
 EL 5141
 Hfs 5568
 IP 5141
 PT 4991, 5425

Sc X CL 5562
 EL 5562
 IP 5827
 SF 5827

Sc XII CL 5973
 EL 5973

Sc XIII AT 5515
 CL 5389, 5515
 EL 5515

Sc XIV AT 5515
 CL 5389, 5515
 EL 5515

Sc XV AT 5579
 CL 5217, 5579
 EL 5217, 5579

Sc XVI CL 5217, 5389, 5600
 EL 5217, 5600

2.2. Reference Numbers for Individual Spectra – Continued

Sc xvii	CL	5217, 5389, 5601	Ti xviii	AT	5004
	EL	5217, 5601		CL	5217, 5291, 5317, 5370, 5560 5601
Sc xviii	CL	5217, 5389		EL	5217, 5601
	EL	5217			
Sc xix	AT	5314	Ti xix	AT	5004, 5961
	CL	5217, 5314, 5389		CL	5217, 5317, 5560
	EL	5217, 5314		EL	5217
Titanium			Ti xx	AT	5004, 5314, 5802
Ti i	AT	5085, 5156, 5221, 5505, 5748		CL	5217, 5314
	Hfs	5435, 5464		EL	5217, 5314
	PT	5013, 5572	Ti xxi	CL	5881
Ti ii	AT	5221, 5748	Vanadium		
	CL	5432	V i	AT	5748, 5791
	EL	5432		CL	5637, 5791
	IP	5432		EL	5637, 5791
	PT	4991, 5432		Hfs	4912, 5435, 5464
Ti iii	AT	5025, 5221, 5271, 5748		PT	5013, 5791
	PT	5025, 5271		W	5791
Ti iv	AT	5221, 5426, 5748, 5842	V ii	AT	5748
Ti v	AT	5748	V iii	AT	5748
Ti x	CL	5962	V iv	AT	5547, 5748
	W	5962		PT	5547
Ti xi	CL	5504, 5962	V v	AT	5748, 5842
	IP	5827	V vii	AT	5159
	SF	5827		PT	5159
	W	5962	V viii	AT	5159
Ti xii	CL	4862, 5962		PT	5159
	EL	4862	V ix	AT	5159
	W	5962		PT	5159
Ti xiii	CL	5962, 5973	V x	AT	5159
	EL	5973		PT	5159
	W	5962	V xii	CL	5504
Ti xiv	AT	5004, 5515		IP	5827
	CL	4971, 5291, 5317, 5370, 5515 5560		SF	5827
	EL	5515		TE	4884
Ti xv	AT	5004, 5515	V xiv	CL	5973
	CL	4971, 5291, 5317, 5370, 5515 5560		EL	5973
	EL	5515	V xv	AT	5515
Ti xvi	AT	5004, 5317, 5579		CL	5515
	CL	5217, 5560, 5579		EL	5515
	EL	5217, 5579	V xvi	AT	5515
Ti xvii	AT	5004		CL	5515
	CL	4971, 5217, 5291, 5317, 5370 5560, 5600		EL	5515
	EL	5217, 5600			

2.2. Reference Numbers for Individual Spectra—Continued

V xvii	AT	5579	Cr xviii	AT	5317, 5652
	CL	5217, 5579		CL	5067, 5205, 5513
	EL	5217, 5579		EL	5205
V xviii	CL	5217, 5600	Cr xix	AT	5007, 5317, 5477
	EL	5217, 5600		CL	5205, 5370, 5477, 5513
				EL	5205
V xix	CL	5217	Cr xx	AT	5317, 5477
	EL	5217		CL	4856, 5205, 5232, 5370, 5477
V xx	CL	5217			5513
	EL	5217		EL	5205
V xxi	AT	5314	Cr xxi	AT	5268, 5477, 5921, 5961
	CL	5217		CL	5067, 5205, 5370, 5477
	EL	5217, 5314		EL	5205
V xxii	AT	5570	Cr xxii	AT	5314, 5477, 5921
	CL	5881		CL	5067, 5205, 5370, 5477
				EL	5205, 5314
Chromium			Cr xxiii	AT	5477, 5921
Cr i	AT	5413, 5748		CL	5067, 5477, 5707, 5847, 5881
	CL	5413, 5487	Manganese		
	EL	5413, 5487	Mn i	AT	4854
	Hfs	5464		CL	4854
	IP	5413		EL	4854
	PT	5413		Hfs	5435, 5464, 5904, 5963
Cr ii	AT	5748		IP	4854
	CL	5665		PT	5013
	EL	5487, 5665		W	4854
Cr iii	AT	5748	Mn ii	EL	5545
Cr iv	AT	5025, 5748		Hfs	5931A
	CL	5498		ND	4991
	EL	5498		PT	4991
	IP	5498	Mn vi	CL	5143
	PT	5025, 5498		EL	5143
Cr v	AT	5748		IP	5143
Cr ix	CL	5316	Mn vii	CL	5223
				EL	5223
Cr xiii	CL	5504	Mn viii	CL	5796
	IP	5827		EL	5796
	SF	5827		PT	5796
	TE	4884	Mn xiv	IP	5827
Cr xiv	CL	5205		SF	5827
Cr xv	CL	5973		TE	4884
	EL	5973	Mn xv	CL	5205
	IP	5121	Mn xvi	CL	5973
Cr xvi	CL	5067, 5205, 5513		EL	5973
	EL	5205		IP	5121
Cr xvii	AT	5007	Mn xvii	AT	5606
	CL	5205, 5513		CL	4904, 5205
	EL	5205		EL	5205

2.2. Reference Numbers for Individual Spectra—Continued

Mn XVIII	AT	5606	Fe XIII	CL	5808	
	CL	4904, 5205				
	EL	5205				
Mn XIX	AT	5606	Fe XIV	AT	5118	
	CL	4904, 5205		CL	5278, 5316	
	EL	5205				
Mn XX	AT	5606	Fe XV	AT	5005, 5175	
	CL	4904, 5205, 5232		CL	5005, 5504	
	EL	4904, 5205		IP	5827	
Mn XXI	AT	5606		PT	5043	
	CL	4904, 5205, 5232		SF	5827	
	EL	4904, 5205		W	4862	
Mn XXII	AT	5606	Fe XVI	CL	5205	
	CL	4904, 5205		W	4862	
	EL	4904, 5205				
Mn XXIII	AT	5314, 5606	Fe XVII	AT	5133, 5599	
	CL	5205		CL	5067, 5090, 5133, 5213, 5278 5973	
	EL	5205, 5314		EL	5973	
Fe I	AT	5059	Fe XVIII	IP	5121	
	CL	5571, 5815		Fe XIX	AT	5133, 5411
	Hfs	4935, 4987, 5435, 5464			CL	5067, 5090, 5133, 5205, 5370 5513, 5531, 5947
	IP	5983A	EL		4861, 5205	
	PT	5013	Fe XX	AT	4901, 5007, 5133, 5274, 5411 5903A	
	W	5571		CL	5067, 5090, 5133, 5205, 5370 5513, 5531, 5784, 5947	
Fe II	AT	5245		EL	5205, 5784	
	CL	5972	Fe XXI	AT	5006, 5297, 5317, 5411, 5753	
	EL	5887		CL	5205, 5300, 5370, 5513, 5531 5784, 5947	
	PT	4991		EL	5006, 5205, 5784	
ND	5006					
Fe V	CL	5293	Fe XXII	AT	4911, 5007, 5297, 5317, 5364 5411, 5774	
				CL	5205, 5300, 5370, 5513, 5531 5784	
Fe VI	CL	5293		EL	5205, 5784	
			Fe XXIII	AT	4943, 4944, 5178, 5297, 5317 5364, 5411	
Fe VII	AT	5267, 5755		CL	5067, 5205, 5300, 5370, 5513 5531, 5784	
	CL	5267		EL	5205, 5784	
	EL	5267	Fe XXIV	AT	4871, 5018, 5229, 5268, 5297 5364, 5368, 5408, 5411, 5422 5731, 5961	
	IP	5267		CL	4859, 4871, 5067, 5205, 5300 5370, 5513, 5531	
	PT	5267		EL	4871, 5205	
Fe VIII	CL	5223, 5808, 5923	Fe XXV	AT	4871, 4901, 4925, 4926, 5314 5364, 5403, 5411, 5570	
	EL	5223		CL	4859, 4871, 4885, 5067, 5205 5643	
Fe IX	CL	5796, 5808		EL	5205, 5314	
	EL	5796	TA	4886, 5844		
	PT	5796	W	4871		
Fe X	AT	5871				
	CL	5808				
	PT	4996				
Fe XI	CL	5808				
Fe XII	CL	5808				

2.2. Reference Numbers for Individual Spectra—Continued

Fe xxv	AT	5184, 5298, 5403, 5616	Co xxiv	CL	5067, 5205	
	CL	4859, 4885, 5320, 5616, 5844 5881, 5923		EL	5205	
	EL	5136, 5320		Co xxv	CL	5067, 5205
	TA	4886			EL	5205
Fe xxvi	CL	4859, 5466, 5844	Co xxvi	CL	5881	
	EL	5136, 5466				
	QF	5706				
Cobalt						
Co i	Hfs	5464, 5963	Ni i	AT	5126	
Co ii	EL	5887		Hfs	5464	
				IS	5126, 5941	
Co vii	CL	5340	Ni ii	CL	5856	
	EL	5340		EL	5856, 5887	
	PT	5340		PT	4991, 5856	
Co viii	CL	5016	Ni iv	CL	5624	
	EL	5016		Ni v	CL	5293, 5624
Co ix	CL	5223	Ni vi		AT	5124
	EL	5223			CL	5124, 5293, 5624
Co xi	CL	5015		EL	5124	
				PT	5124	
Co xii	CL	5015	Ni ix	CL	5016	
Co xiii	CL	5015		W	5102	
			Co xiv	CL	5015	Ni x
EL	5223					
W	5102					
Co xv	CL	5015	Ni xi	W	5102	
Co xvi	CL	5015		Ni xii	AT	5159
	IP	5827	CL		5015	
	SF	5827	PT		5159	
	TE	4884	W		5102	
Co xvii	CL	5015, 5205	Ni xiii	AT	5159	
Co xviii	CL	5067, 5090 5121		CL	5015	
				PT	5159	
Co xix	CL	5067, 5090, 5205	Ni xiv	AT	5159	
	EL	4861, 5205		CL	5015	
Co xx	CL	5067, 5090, 5205		PT	5159	
	EL	5205	Ni xv	AT	5159	
Co xxi	AT	5317		CL	5015	
	CL	5205		PT	5159	
	EL	5205	Ni xvi	CL	5015	
Co xxii	AT	5317		Ni xvii	AT	5005
	CL	5205			CL	5005, 5015, 5562
	EL	5205			EL	5562
Co xxiii	AT	5317			IP	5827
	CL	5067, 5205			PT	5043
	EL	5205	SF		5827	
	Ni xviii	CL	5015, 5205			

2.2. Reference Numbers for Individual Spectra—Continued

Ni xix	CL	5067, 5090	Cu xi	CL	5223
	IP	5121		EL	5223
Ni xx	CL	4861, 5067, 5090, 5205, 5370	Cu xiii	CL	5835
		5513			
	EL	4861, 5205	Cu xiv	CL	5835
Ni xxi	AT	4901, 5007	Cu xv	CL	5835
	CL	5067, 5090, 5205, 5370, 5513	Cu xvi	CL	5835
	EL	5205			
Ni xxii	AT	5317	Cu xvii	CL	5835
	CL	4856, 5205, 5513			
	EL	5205	Cu xviii	CL	5562, 5835
Ni xxiii	AT	5007, 5317		EL	5562
	CL	4856, 5205, 5232, 5370, 5513		IP	5827
	EL	5205		SF	5827
Ni xxiv	AT	5317	Cu xx	CL	5090, 5122, 5243
	CL	4856, 5067, 5205, 5232, 5370		EL	5122
		5513		IP	5121
	EL	5205	Cu xxi	AT	4951
Ni xxv	AT	4871, 5268		CL	4861, 5090, 5122, 5243, 5513
	CL	4871, 5205		EL	4861, 5122
	EL	4871, 5205		PT	4951
Ni xxvi	AT	4871	Cu xxii	CL	5090, 5243, 5513
	CL	4871, 5067, 5205			
	EL	5205	Cu xxiii	CL	5243, 5513
	W	4871	Cu xxiv	CL	5513
Ni xxvii	CL	5881	Cu xxv	CL	5513
			Cu xxviii	CL	5881
		Copper			Zinc
Cu	W	5048			
Cu i	AT	5577	Zn i	AT	5380
	CL	4958		EL	5324
	EL	4958		Hfs	5640
	Hfs	4873, 5464		IS	5640
	IP	4958		PT	5380
	IS	4873			
Cu ii	CL	5172	Zn ii	EL	5324
	EL	5708		PT	4991
	PT	4991, 5775			
Cu iv	AT	5144	Zn v	AT	5932
	CL	5144		CL	5535, 5932
	EL	5144		EL	5535, 5932
	IP	5144		PT	5932
	PT	5144	Zn xiv	CL	5835
Cu vi	AT	5285	Zn xviii	CL	5835
	CL	5285			
	EL	5285	Zn xix	CL	5835
	PT	5285		IP	5827
				SF	5827
Cu x	CL	5016	Zn xx	AT	5045, 5185

2.2. Reference Numbers for Individual Spectra – Continued

Zn XXI	CL EL IP	5090, 5122 5122 5121	Germanium		
			Ge IV	PT	4867
Zn XXII	AT CL EL PT	4951 5090, 5122 4861, 5122 4951	Ge VI	AT CL EL	5038 5038 5038
Zn XXIII	CL	5090	Ge VII	AT CL EL	5321 5321 5321
Zn XXIV	AT	5652	Ge XIV	CL	5797
Zn XXVII	AT	5961	Ge XV	CL	5797
Zn XXIX	CL PT	5881 5208	Ge XVI	CL	5797, 5835
Gallium			Ge XVII	CL	5761, 5797, 5835
Ga	W	5378	Ge XVIII	CL	5797, 5835
Ga I	AT CL EL Hfs IP IS PT SE SF	4895, 5266, 5493, 5673 5493, 5566, 5673 5493, 5566, 5673 4960, 4966, 5639, 5641, 5809 5566 4960, 5566, 5639, 5641 5266 4966 5566	Ge XIX	CL	5797, 5835
			Ge XX	CL	5761, 5797, 5835
			Ge XXI	CL EL IP SF	5562, 5835 5562 5827 5827
			Ge XXII	CL	5090
Ga II	AT	5469	Ge XXIII	CL IP	5090 5121
Ga VI	AT CL EL PT	5952 5952 5952 5952	Ge XXIV	AT CL EL PT	4951 5090, 5513 4861 4951
Ga XV	CL	5835	Ge XXV	CL	5090, 5513
Ga XVI	CL	5761	Ge XXVI	CL	5513
Ga XIX	CL	5835	Ge XXVII	CL	5513
Ga XX	CL IP SF	5835 5827 5827			
Ga XXI	CL	5090	As I	AT CL EL Hfs ND PT ZE	5030 5030 5030 4952, 5958 5030 5030 5030
Ga XXII	CL EL IP	5090, 5122 5122 5121			
Ga XXIII	AT CL EL PT	4951 5090, 5122 5122 4951	As IV	CL	5339
Ga XXIV	CL	5090	As V	CL IP ND PT	5339 5339 5629 4867
Ga XXX	PT	5208			

2.2. Reference Numbers for Individual Spectra—Continued

As VI	AT	5000	Se XXIII—Continued	IP	5827
	CL	5000		SF	5827
	EL	5000			
	IP	5000			
	PT	5000			
As VII	AT	5000	Se XXIV	CL	5090
	CL	5000			
	EL	5000	Se XXV	CL	5090
	PT	5000		IP	5121
As XVII	CL	5835	Se XXVI	CL	5090
				EL	4861
As XX	CL	5761	Se XXVII	CL	5090
As XXI	CL	5761, 5835	Bromine		
			Br I	AT	5194
As XXII	CL	5835		CL	5454, 5681, 5765
	IP	5827		EL	5454, 5765
	SF	5827		IS	5276
				ZE	5194
As XXIII	CL	5090	Br VII	CL	5242
				EL	5242
As XXIV	CL	5090, 5122		PT	4867
	EL	5122			
	IP	5121			
As XXV	AT	4951	Br VIII	CL	5343, 5472
	CL	5090, 5122			
	EL	5122	Br IX	AT	5472
	PT	4951		CL	5343, 5472
		EL		5343, 5472	
As XXVI	CL	5090	PT	5343	
			Br XXIV	IP	5827
Selenium		SF		5827	
Se I	AT	5058	Br XXV	CL	5090
	CL	5688			
	EL	5688	Br XXVI	CL	5090, 5122
	W	5688		EL	5122
Se V	CL	5556	Br XXVII	CL	5090, 5122
	EL	5556		EL	5122
	ND	5629			
Se VI	PT	4867	Br XXVIII	CL	5090
Se XVI	CL	5797	Br XXXII	AT	5961
Se XVII	CL	5797	Krypton		
			Kr I	CL	5132, 5497, 5685
Se XVIII	CL	5797, 5835		EL	5019, 5497, 5586, 5685, 5801
					5855
Se XIX	CL	5797, 5835		Hfs	4914
				IP	5480, 5685, 5976
Se XX	CL	5797, 5835		IS	5140, 5728
				PT	5480
Se XXI	CL	5797, 5835		ZE	4879, 5522, 5787
Se XXII	CL	5797, 5835	Kr II	AT	5066, 5418, 5419, 5954
Se XXIII	CL	5562, 5835	Kr III	AT	5575
	EL	5562		EL	5859

2.2. Reference Numbers for Individual Spectra – Continued

Kr IV	CL	5117	Rubidium			
Kr V	CL	5117				
Kr VIII	AT	4956	Rb I	AT	4894, 5049, 5284, 5450, 5551	
	CL	4956		CL	4970, 5783	
	EL	4956		EL	4889, 4970, 5150, 5783	
	PT	4867		Hfs	4970, 4972, 5021, 5027, 5390 5768, 5898, 5969, 5981	
Kr IX	TA	5917		IP	4970, 5106, 5783	
				IS	4889, 4970, 5021, 5390, 5768	
				SE	4892, 4976, 5021	
				SF	4970	
Kr X	TA	5917		TA	4892	
Kr XI	TA	5046, 5853, 5917	Rb II	EL	5061, 5070, 5209	
Kr XII	TA	5046, 5853, 5917	Rb IX	PT	4867	
Kr XIII	TA	5046, 5853	Rb XII	AT	5979	
				CL	5979	
				EL	5979	
				PT	5979	
Kr XIV	TA	5046, 5853	Rb XXVI	IP	5827	
Kr XX	CL	5835		SF	5827	
Kr XXI	CL	5761, 5835				
Kr XXIII	CL	5835				
			Rb XXVIII	CL	5122	
				EL	5122	
			Rb XXIX	CL	5122	
Kr XXIV	CL	5835		EL	5122	
Kr XXV	CL	5562, 5835	Rb XXXVI	PT	5208	
	EL	5562				
	IP	5827				
	SF	5827				
Kr XXVI	AT	4863, 5045	Strontium			
	CL	4863, 5862A				
	EL	4863	Sr I	AT	5134, 5181, 5284, 5365, 5452 5734	
				CL	5134, 5452, 5826	
Kr XXVII	AT	4863, 5866		EL	5134, 5452, 5578, 5644, 5826	
	CL	4863		Hfs	5356, 5702, 5721, 5734, 5849	
	EL	4863		IP	5280	
Kr XXVIII	AT	4863		IS	5483, 5593, 5676, 5721, 5734 5900, 5926	
	CL	4863, 5862A		PT	4909, 5365, 5700	
	EL	4863		TA	5701	
Kr XXIX	AT	5645	Sr II	AT	5452	
	CL	5862A		IS	5593	
Kr XXX	AT	5645	Sr IX	W	5322	
Kr XXXI	AT	5645	Sr X	AT	5322	
Kr XXXII	AT	5645		CL	5322	
				EL	5322	
				IP	5322	
			Sr XI	CL	5322	
Kr XXXIII	AT	5169, 5645, 5731, 5961		W	5322	
	CL	5169	Sr XII	AT	5521	
Kr XXXIV	AT	5169, 5645		CL	5521	
	CL	5169		EL	5521	
Kr XXXV	AT	5184		PT	5521	
				W	5322	

2.2. Reference Numbers for Individual Spectra—Continued

Sr XIII	AT	5288, 5885, 5979	Y XIV—Continued	EL	5260, 5288, 5785, 5885	
	CL	5288, 5885, 5979		PT	5288, 5785, 5885	
	EL	5288, 5885, 5979				
	PT	5288, 5885, 5979				
Sr XIV	AT	5896	Y XV	AT	5896	
				CL	5896	
				EL	5896	
Sr XXII	CL	5835			PT	5896
Sr XXIII	CL	5835	Y XXVIII	CL	5794	
				EL	5794	
Sr XXVI	CL	5835			IP	5827
					SF	5827
Sr XXVII	CL	5562, 5794, 5835	Y XXX	IP	5121	
	EL	5562, 5794				
	IP	5827	Y XXXI	AT	5598	
	SF	5827		CL	5598	
		EL		5598		
Sr XXIX	CL	5122	Y XXXVII	AT	5961	
	EL	5122				
Sr XXX	AT	5598				
	CL	5122, 5598				
	EL	5122, 5598				

2.2. Reference Numbers for Individual Spectra—Continued

Zr XII—Continued			Nb v		
	IP	4917		CL	5437, 5524
	PT	4867, 5296, 5376		EL	5437, 5524
	TA	5557		Hfs	5437
				IP	5437, 5524
Zr XIII			Nb vi		
	AT	5187		CL	5527
	CL	5187		EL	5527
	EL	5187			
Zr XIV			Nb vii		
	AT	5521		EL	5318
	CL	5521, 5581, 5821	Nb ix		
	EL	5521, 5581		AT	5287
	PT	5521, 5581		CL	5287
				EL	5287
Zr xv				IP	5287
	AT	5288, 5885		PT	5287
	CL	5260, 5288, 5785, 5821, 5885	Nb xii		
	EL	5260, 5288, 5785, 5885		AT	5489
	PT	5288, 5785, 5885		CL	5296, 5489
				EL	5489
Zr xvi				PT	5489
	AT	5896	Nb xiii		
	CL	5896		AT	4998, 5296, 5376, 5489
	EL	5896		CL	4998, 5296, 5376, 5489
	PT	5896		EL	4867, 4998, 5296, 5489
Zr xxi				IP	4998
	CL	5821		PT	4867, 5296, 5376, 5489
Zr xxii			Nb xiv		
	CL	5821		AT	5187, 5489
Zr xxiv				CL	5187, 5489
	CL	5835		EL	5187, 5489
Zr xxv				PT	5489
	CL	5835	Nb xv		
Zr xxvi				AT	5489, 5521
	CL	5835		CL	5489, 5521, 5581
Zr xxvii				EL	5489, 5521, 5581
	CL	5821, 5835		PT	5489, 5521, 5581
Zr xxviii			Nb xvi		
	CL	5835		AT	5288, 5885
Zr xxix				CL	5260, 5288, 5785, 5885
	CL	5562, 5794, 5835		EL	5260, 5288, 5785, 5885
	EL	5562, 5794		PT	5288, 5785, 5885
	IP	5827		TA	5489
	SF	5827	Nb xvii		
Zr xxxi				AT	5896
	CL	4850		CL	5896
Zr xxxii				EL	5896
	CL	4850		PT	5896
	W	4850		TA	5489
Zr xxxiii			Nb xxv		
	CL	4850		CL	5835
	W	4850	Nb xxix		
				CL	5835
			Nb xxx		
				CL	5794, 5835
				EL	5794
				IP	5827
				SF	5827
			Nb xxxiii		
				W	4850
			Nb xxxiv		
				W	4850
			Nb xxxix		
				CL	4855
			Nb xl		
				CL	4855

Niobium

2.2. Reference Numbers for Individual Spectra—Continued

Molybdenum		
Mo I	IS	5333
Mo VI	CL	5295
Mo VIII	CL	5295
	EL	5318
Mo X	AT	5287
	CL	5287
	EL	5287
	IP	5287
	PT	5287
Mo XII	CL	5295
Mo XIII	CL	5083, 5295, 5296
Mo XIV	AT	5247, 5296, 5376, 5927
	CL	5083, 5247, 5296, 5376
	EL	5247, 5296
	ND	5247
	PT	4867, 5296, 5376
	TA	5093
Mo XV	AT	5187
	CL	5083, 5187
	EL	5187
	TA	5441
Mo XVI	AT	4922, 5083, 5521, 5675
	CL	5083, 5396, 5521, 5581, 5675
		5821
	EL	5083, 5521, 5581, 5675
	PT	5521, 5581
	TA	5441
Mo XVII	AT	5260, 5288, 5885, 5970
	CL	5083, 5260, 5288, 5785, 5821
		5885
	EL	5260, 5288, 5785, 5885
	PT	5288, 5785, 5885
	TA	5441
Mo XVIII	AT	5896
	CL	5083, 5896
	EL	5896
	PT	5896
	TA	5441
Mo XIX	TA	5441
Mo XX	TA	5441
Mo XXI	TA	5441
Mo XXII	TA	5441
Mo XXIII	CL	5821
Mo XXIV	CL	5821
Mo XXVI	CL	5835
Mo XXVII	CL	5835
Mo XXVIII	CL	5835
Mo XXIX	AT	5830
	CL	5821, 5830, 5835
Mo XXX	AT	5830
	CL	5830, 5835
Mo XXXI	AT	5830
	CL	5562, 5794, 5830, 5835
	EL	5562, 5794
	IP	5827
	SF	5827
Mo XXXII	AT	5045, 5830
	CL	5830
Mo XXXIII	AT	5599, 5830
	CL	5830
Mo XXXIV	W	4850
Mo XXXV	W	4850
Mo XXXIX	AT	5731, 5961
Technetium		
Tc I	AT	5848A
Tc XV	PT	4867
Tc XXXII	PT	5827
	SF	5827
Ruthenium		
Ru I	Hfs	5655
	ZE	5655
Ru XVI	AT	5376
	CL	5376, 5953
	EL	5953
	IP	5953
	PT	4867, 5376
Ru XVII	AT	5187
	CL	5187
	EL	5187
Ru XVIII	CL	5581
	EL	5581
	PT	5581
Ru XIX	CL	5785
	EL	5785
	PT	5785
Ru XX	AT	5896
	CL	5896
	EL	5896
	PT	5896

2.2. Reference Numbers for Individual Spectra — Continued

Ru xxxiii CL 5794
EL 5794
PT 5827
SF 5827

Ru xli AT 5961

Rhodium

Rh xvii AT 5376
CL 5376, 5953
EL 5953
IP 5953
PT 4867, 5376

Rh xviii AT 5187
CL 5187
EL 5187

Rh xix CL 5581
EL 5581
PT 5581

Rh xx CL 5785
EL 5785
PT 5785

Rh xxi AT 5896
CL 5896
EL 5896
PT 5896

Rh xxxiv CL 5794
EL 5794
PT 5827
SF 5827

Palladium

Pd i Hfs 5400

Pd xviii AT 5376
CL 5376, 5953
EL 4867, 5953
IP 5031, 5953
PT 4867, 5376

Pd xix AT 5187
CL 5187
EL 5187
TA 5441

Pd xx CL 5581
EL 5581
PT 5581
TA 5441

Pd xxi CL 5785
EL 5785
PT 5785
TA 5441

Pd xxii AT 5896
CL 5896
EL 5896
PT 5896
TA 5441

Pd xxiii TA 5441

Pd xxiv TA 5441

Pd xxv TA 5441

Pd xxvi TA 5441

Pd xxvii TA 5441

Silver

Ag i AT 4894, 5577, 5874
CL 5874
EL 5874

Ag ii EL 5070, 5204

Ag iv AT 5555, 5680
CL 5555, 5680
EL 5555, 5680
PT 5555

Ag xvii W 5440

Ag xviii W 5440

Ag xix AT 5376
CL 5376, 5953
EL 4867, 5953
IP 5031, 5953
PT 4867, 5376
W 5440

Ag xx AT 5187
CL 5187
EL 5187

Ag xxi CL 5581
EL 5581
PT 5581

Ag xxii CL 5785
EL 5785
PT 5785

Ag xxiii AT 5896
CL 5896
EL 5896
PT 5896

Ag xxxviii CL 5325

Cadmium

Cd i AT 4959
CL 5308

2.2. Reference Numbers for Individual Spectra—Continued

Cd I—Continued			In XXI	CL	5953
	EL	5308		EL	4867, 5953
	Hfs	5354		IP	5031, 5953
	IS	5354		PT	4867
	SE	4865			
	W	5308	In XL	CL	5325
	ZE	5139A, 5632			
					Tin
Cd II	CL	5172	Sn I	Hfs	5529, 5843
	Hfs	4977		IS	5843
Cd III	CL	5192	Sn II	SE	5747
	EL	5192		ZE	4985
	IP	5192			
	PT	5192	Sn V	AT	5534
Cd IV	CL	5055		CL	5534
	EL	5055		EL	5534
	PT	5055		IP	5534
				PT	5534
Cd V	CL	5573, 5574	Sn XX	CL	5439
	EL	5573, 5574		W	5439
	PT	5574			
Cd XX	CL	5953	Sn XXI	CL	5439
	EL	4867, 5953		W	5439
	IP	5031, 5953			
	PT	4867	Sn XXII	AT	5692
Cd XXXIX	CL	5325		CL	5439, 5953
				EL	5953
				IP	5953
				PT	4867
				W	5439
Cd XLV	AT	5961			
Indium			Sn XLI	CL	5325
In I	AT	4895, 5266, 5384, 5433, 5493			Antimony
	CL	5024, 5384, 5433, 5462, 5493			
		5566	Sb I	CL	4893
	EL	5024, 5384, 5433, 5462, 5493		EL	4893
		5566, 5861		Hfs	5529
	Hfs	4916, 4960, 5363, 5384, 5529		IP	4893
		5544, 5809		ZE	5872
	IP	5384, 5462, 5566, 5717			
	IS	4960, 5363, 5566	Sb II	ND	5109A, 5119A
	PT	5266		PT	5109A, 5119A
	SF	5566		SE	5747
	W	5024			
In II	AT	5433	Sb VI	AT	4906
	CL	5433		CL	4883, 4906
	EL	5096, 5433		EL	4883, 4906, 5250
				PT	4883, 4906
In IV	AT	5534	Sb VII	AT	5107
	CL	5534		CL	5107
	EL	5534		EL	5107
	IP	5534		PT	5107
	PT	5534			
In VI	AT	5436, 5604	Sb XXIII	PT	4867
	CL	5436, 5604			
	EL	5436, 5604			Tellurium
	PT	5436, 5604	Te I	AT	5058
				CL	5346, 5704, 5789, 5813, 5880

2.2. Reference Numbers for Individual Spectra—Continued

Te I—Continued

EL	5704, 5789, 5813, 5880
IP	5789, 5880
IS	4887
PT	5760
W	5346

Te II	Hfs	5335, 5398
	PT	5398

Te VII	AT	4906, 5174
	CL	4883, 4906, 5174
	EL	4883, 4906, 5174, 5250
	PT	4883, 4906, 5174

Te VIII	AT	5174
	CL	5174
	EL	5174
	PT	5174

Te XXIV	PT	4867
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Iodine

I I	AT	5194
	CL	5303, 5346, 5454, 5886
	EL	5303, 5886
	Hfs	5087, 5282, 5638
	IP	5886
	IS	5087
	PT	5749
	W	5346
	ZE	5194, 5282

I II	PT	5760
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I VI	CL	4896
	EL	4896
	IP	4896

I VII	CL	4896, 5438
	EL	5438
	IP	5438, 5532

I VIII	CL	5678
	EL	5678

I IX	CL	5218
	EL	5218
	PT	5218

I XXV	PT	4867
	W	5330

Xenon

Xe I	AT	5470, 5691, 5739
	CL	5008, 5509, 5558
	EL	5019, 5272, 5509, 5558, 5667 5855
	Hfs	5210, 5409, 5705, 5825, 5930A
	IP	5272, 5966, 5976
	IS	5728
	SF	5272

Xe I—Continued

TA	5154
W	4933, 5421
ZE	4879, 5522, 5705, 5787, 5825

Xe II	AT	5418, 5419
	Hfs	4851, 5326, 5614
	IS	4851, 5326, 5614
	PT	5115
	SE	5745
	W	5421, 5583

Xe III	AT	5193, 5575
	CL	5428, 5583, 5782
	EL	5428, 5782
	IP	5938
	PT	5428, 5760
	W	5421, 5583

Xe IV	IP	5938
	W	5421, 5583

Xe VI	AT	5623
	CL	5117
	ND	5623

Xe VII	AT	5691, 5852
	CL	4915, 5622, 5852
	EL	4915, 5120, 5852
	IP	4915

Xe VIII	AT	5691, 5852
	CL	4900, 5120, 5256, 5438, 5852
	EL	4900, 5120, 5256, 5438, 5852
	IP	4900, 5438, 5532
	PT	5256

Xe IX	AT	5691, 5852
	CL	5678, 5852
	EL	5678, 5852

Xe X	AT	5841
	CL	5841
	EL	5841
	PT	5841

Xe XVII	AT	5691
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Xe XXV	AT	5100
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Xe XXVI	AT	5100
	PT	4867

Xe XXVIII	AT	5675
	CL	5675
	EL	5675

Xe XLIV	AT	5415
	CL	5415

Xe XLV	AT	5415
	CL	5415

Xe XLVI	AT	5415
	CL	5415

2.2. Reference Numbers for Individual Spectra — Continued

Xe XLVII	AT	5415	Ba I—Continued	Hfs	5011, 5022, 5510, 5512, 5517 5543, 5550, 5594, 5595, 5609 5721, 5722, 5781
	CL	5415			
Xe LI	AT	5961		IP	5401
Cesium				IS	5011, 5022, 5104, 5483, 5510 5512, 5520, 5609, 5721, 5781
Cs I	AT	5289, 5551, 5792, 5919			
	CL	4891, 5289, 5605, 5726, 5733 5756, 5919		PT	4909, 5011, 5328, 5352, 5584 5587, 5594, 5694, 5696, 5711 5722, 5727, 5957, 5977
	EL	4891, 4940, 5103A, 5177, 5224 5226, 5228, 5289, 5726, 5733 5756, 5919			
	Hfs	4940, 5023, 5027, 5382, 5474 5533, 5580, 5662, 5726, 5733 5768		SE	5040, 5328, 5957
	IP	4891, 5177, 5289, 5580, 5750 5756, 5783			
	IS	5533, 5768		SF	5590
	SE	4976, 5371, 5564, 5773, 5840			
	SF	5495, 5733		TA	4909, 5010, 5064, 5248, 5771
	TA	4897, 5762			
Cs II	AT	4978, 5605, 5739		ZE	5239, 5630
	CL	5173, 5605			
	EL	5056, 5173, 5209, 5605		Ba II	AT 5039, 5212, 5516, 5714, 5858 5868
	Hfs	4853, 4927, 4978, 5605			
	IP	5605		CL	5516
	ND	5173			
	PT	5605		EL	4965, 5062, 5286, 5516
Cs III	AT	5605		Hfs	5105, 5478, 5647, 5698, 5699
	CL	5605			
	EL	5605		IS	5105, 5766, 5772
	Hfs	5605			
	PT	5605		PT	5977
Cs IV	CL	5760			
	EL	5760		ZE	5332
	PT	5760			
				Ba III	AT 5414, 5516, 5739, 5858
Cs IX	CL	5438			
	EL	5438		CL	5516
	IP	5438, 5532			
Cs X	CL	5678		EL	5516
	EL	5678			
Cs XI	AT	5250		PT	5977
	CL	5250			
	EL	5250		TA	5154
	PT	5250			
Barium				Ba V	CL 5760 EL 5760 PT 5760
Ba I	AT	5039, 5181, 5516, 5858, 5868 5910, 5946			Ba X
	CL	5063, 5167, 5249, 5516, 5694 5711, 5723, 5929, 5978			
	EL	4864, 4965, 5249, 5286, 5328 5516, 5584, 5587, 5590, 5694 5711, 5722, 5723, 5727, 5913 5978		CL	5438 5438 5438, 5532
	AT	5039, 5181, 5516, 5858, 5868 5910, 5946		EL	5678 5678
	CL	5063, 5167, 5249, 5516, 5694 5711, 5723, 5929, 5978			
	EL	4864, 4965, 5249, 5286, 5328 5516, 5584, 5587, 5590, 5694 5711, 5722, 5723, 5727, 5913 5978		Ba XI	CL 5678 EL 5678
	AT	5039, 5181, 5516, 5858, 5868 5910, 5946		Ba XII	AT 5820 CL 5820 EL 5820 PT 5820
	CL	5063, 5167, 5249, 5516, 5694 5711, 5723, 5929, 5978			
	EL	4864, 4965, 5249, 5286, 5328 5516, 5584, 5587, 5590, 5694 5711, 5722, 5723, 5727, 5913 5978		Ba XXVII	AT 5100 CL 5100
	AT	5039, 5181, 5516, 5858, 5868 5910, 5946		Ba XXVIII	CL 5473 EL 5473 IP 5473
	CL	5063, 5167, 5249, 5516, 5694 5711, 5723, 5929, 5978			
	EL	4864, 4965, 5249, 5286, 5328 5516, 5584, 5587, 5590, 5694 5711, 5722, 5723, 5727, 5913 5978		Ba XXX	AT 5675 CL 5675 EL 5675
Lanthanum				La I	Hfs 4932, 5963 IS 4932
	AT	5039, 5181, 5516, 5858, 5868 5910, 5946			
	CL	5063, 5167, 5249, 5516, 5694 5711, 5723, 5929, 5978		La II	Hfs 5020, 5138A, 5482, 5514
	EL	4864, 4965, 5249, 5286, 5328 5516, 5584, 5587, 5590, 5694 5711, 5722, 5723, 5727, 5913 5978			

2.2. Reference Numbers for Individual Spectra—Continued

La VI	CL	5760	Pr XIII	CL	5532
	EL	5760		EL	5532
	PT	5760		IP	5532
La XI	CL	5438	Pr XIV	CL	5678
	EL	5438		EL	5678
	IP	5438, 5532			
La XII	CL	5678			
	EL	5678			
La XXVIII	AT	5100			
	CL	5100			
La XXXI	AT	5675			
	CL	5675			
	EL	5675			
La XXXIX	CL	5473			
	EL	5473			
	IP	5473			
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2.2. Reference Numbers for Individual Spectra—Continued

Sm XXXIV	CL	5473	Terbium		
	EL	5473			
	IP	5473			
Sm XXXV	ND	4974	Tb III	PT	5251
Sm XXXVI	AT	5675	Tb XIX	CL	5532
	CL	5675		EL	5532
	EL	5675	Tb XX	CL	5678
Europium				EL	5678
			Dysprosium		
Eu I	CL	5889	Dy I	Hfs	5116, 5712, 5713
	EL	5077, 5889		IS	5130, 5567, 5582, 5713, 5799
	Hfs	4954, 5215, 5362, 5442, 5499			5877
		5653, 5864, 5963		ND	5582, 5799
	IS	4954, 5442, 5499, 5628, 5864		W	5567
Eu II		5877, 5959, 5963	Dy II	IS	5850
	Hfs			PT	5850
Eu III	IS	4954	Dy XX	CL	5532
	CL	5137		EL	5532
	IS	4954	Dy XXI	CL	5678
Eu XVII	PT	5251		EL	5678
	CL	5532	Dy XXXVII	AT	5100
	EL	5532		CL	5100
Eu XVIII	IP	5532	Dy XXXVIII	CL	5473
	CL	5678		IP	5473
	EL	5678	Dy XXXIX	ND	4974
Gadolinium			Dy XL	AT	5675
				CL	5675
Gd I	IS	5636		EL	5675
Gd II	PT	5251	Holmium		
Gd XII	AT	5838	Ho I	CL	5657
Gd XVIII	CL	5532		EL	5657
	EL	5532		Hfs	5488, 5657
Gd XIX	CL	5678		ZE	5488
	EL	5678	Ho XXI	CL	5532
Gd XXXV	AT	5100		EL	5532
	CL	5100	Ho XXII	CL	5678
Gd XXXVI	AT	5100, 5927		EL	5678
	CL	5100, 5473, 5927	Ho XXXIX	CL	5980A
	EL	5473, 5927	Erbium		
	IP	5473	Er I	CL	5246
Gd XXXVII	ND	4974		EL	5246
				Hfs	5712, 5908
Gd XXXVIII	AT	5675		IS	5884
	CL	5675		PT	5884
	EL	5675		W	5246
Gd LXI	AT	5961	Er III	AT	5026

2.2. Reference Numbers for Individual Spectra—Continued

Er IV	EL	5870	Yb II—Continued	EL	4907, 4965, 5253, 5920
	PT	5251		Hfs	5804, 5839
Er XXXIX	AT	5100		PT	4907
	CL	5100		ZE	4907
Er XL	AT	5100	Yb XLI	AT	5692
	CL	5100, 5473		CL	5100, 5692, 5980A
	EL	5473		EL	5692
	IP	5473	Yb XLII	AT	5692, 5927
Er XLII	AT	5675		CL	5473, 5692, 5927
	CL	5675		EL	5473, 5692, 5927
	EL	5675		IP	5473
Thulium			Yb XLIII	AT	5374
Tm I	AT	5823		CL	5374
	Hfs	5108	Yb XLIV	AT	5675
Tm IV	AT	5025, 5026		CL	5675
	EL	5306		EL	5675
	PT	5025, 5251, 5306	Lutetium		
Tm XL	AT	5692	Lu I	AT	5823
	CL	5692		Hfs	5111, 5974
	EL	5692		IS	5111, 5974
Tm XLI	AT	5375, 5692, 5927	Lu II	AT	5823
	CL	5375, 5692, 5927	Lu III	AT	4997, 5754, 5823
	EL	5692, 5927	Lu IV	AT	5341
	W	5375		CL	5341
Tm XLII	AT	5374		EL	5341
	CL	5374		PT	5341
Tm XLIII	AT	5375, 5692	Hafnium		
	CL	5375, 5692	Hf I	Hfs	5110
	EL	5692		IS	5110
	W	5375	Hf IV	AT	4997
Tm XLIV	AT	5692	Hf V	AT	5341
	CL	5692		CL	5341
	EL	5692		EL	5341
Ytterbium				PT	5341
Yb I	AT	4907, 5257, 5334, 5537, 5823	Hf XLIII	AT	5692
		5851		CL	5692
	CL	4907, 5410, 5461		EL	5692
	EL	4907, 4965, 5231, 5253, 5257	Hf XLIV	AT	5692, 5927
		5410, 5461, 5920		CL	5692, 5927
	Hfs	4866, 4947, 5157, 5448		EL	5692, 5927
	IS	4866, 4947, 5076, 5097, 5157	Hf XLV	AT	4974
		5743, 5963		CL	4974
	ND	4980, 5076, 5410	Hf XLVI	A	5692
	PT	4907, 4980, 5157, 5410		CL	5692
	SE	5147		EL	5692
	TA	5010			
	ZE	4907, 5399			
Yb II	AT	4907, 4997, 5671, 5823			
	CL	4907			

Tantalum			Rhenium			
Ta I	Hfs	5233, 5937	Re I	Hfs	4954, 5082, 5656	
	ZE	5233		IS	4954, 5082	
Ta VI	AT	5341		PT	5656	
	CL	5341		ZE	5656	
	EL	5341	Re XLVI	AT	5692	
	PT	5341		CL	5692	
		EL		5692		
Ta XLIV	AT	5692	Re XLVII	AT	5692, 5927	
	CL	5100, 5692		CL	5692, 5927	
	EL	5692		EL	5692, 5927	
Ta XLV	AT	5692	Re XLVIII	AT	4974	
	CL	5473, 5692		CL	4974	
	EL	5473, 5692	Re XLIX	AT	5692	
	IP	5473		CL	5692	
	PT	4867		EL	5692	
Ta XLVI	AT	4974, 5374, 5927	Osmium			
	CL	4974, 5374, 5927	Os XLVIII	PT	4867	
	EL	5927		Iridium		
Ta XLVII	AT	5692		Ir I	Hfs	5906A
	CL	5692	Ir XVII		AT	5235, 5621, 5891
	EL	5692			Ir XLIX	PT
Tungsten			Platinum			
W VII	AT	5341	Pt I	IS	4945	
	CL	5341		PT	4945	
	EL	5341		ZE	5810	
	PT	5341	Pt XLIX	AT	5692	
W XIII	AT	5621		CL	5692	
				EL	5692	
	W XIV	AT	5235, 5891	Pt L	AT	5692
W XXVIII		CL	5227, 5532		CL	5692
		EL	5532		EL	5692
W XLV	AT	5692	Pt LI		CL	4975
	CL	5100, 5692		Pt LII	AT	5692
	EL	5692			CL	5692
W XLVI	AT	5375, 5692			EL	5692
	CL	5100, 5375, 5473, 5692	PT	4867		
	EL	5473, 5692	Pt LII	AT	5692	
	IP	5473		CL	5692	
	PT	4867		EL	5692	
	W	5375	Gold			
W XLVII	AT	4974, 5374	Au I	CL	4880	
	CL	4974, 5374		EL	4880	
	W XLVIII	AT		5375, 5675, 5692	IS	5668, 5933A
		CL		5375, 5675, 5692	W	4880
EL		5675, 5692	Au II	CL	5172	
W		5375				
W LXXI	AT	5731, 5961				

2.2. Reference Numbers for Individual Spectra—Continued

Au XIX	AT	5235, 5621, 5891	Bi I—Continued		
Au LI	PT	4867		IS	5975A
				W	5196
		Mercury	Bi II	AT	4920
Hg I	AT	5697		Hfs	4920
	CL	5697		SE	5747
	EL	5361, 5697	Bi III	PT	5266
	Hfs	5427			Francium
	IP	5697	Fr	AT	5719
	IS	5292, 5349, 5788			
	ND	5956	Fr I	CL	5281
	ZE	5427		Hfs	5738, 5768
Hg II	CL	5190		IS	5281, 5768
	EL	5190			Radium
Hg LII	PT	4867			
Hg LXXIII	AT	5274	Ra I	CL	4979
		Thallium		EL	4979
Tl	W	5378		IP	4979
				PT	4909, 4979
Tl I	AT	4895, 5266, 5493, 5836			Thorium
	CL	5461, 5493, 5836	Th I	CL	5951
	EL	5461, 5493, 5836		EL	5342, 5951
	ND	5266		IS	5724
	PT	5266	Th II	CL	5951
Tl II	CL	5190		EL	5951
	EL	5069, 5096, 5190	Th III	CL	5541, 5951
Tl LIII	PT	4867		EL	5541, 5951
		Lead		IP	5541
Pb I	CL	5196, 5519		PT	5541
	EL	5196, 5519, 5948	Th VIII	TA	5359
	Hfs	5394A, 5822	Th IX	TA	5359
	IS	5191, 5394A, 5459, 5561, 5672	Th X	TA	5359
		5822, 5925A	Th XI	TA	5359
	PT	5942	Th XII	TA	5359
	W	5196	Th XIII	TA	5359
Pb II	CL	5190, 5519	Th XIV	TA	5359
	EL	5190, 5207, 5519	Th XV	TA	5359
	SE	5747	Th XVI	TA	5359
Pb XXI	AT	5621			Uranium
Pb XXII	AT	5235, 5891	U I	CL	5037, 5145, 5471, 5494, 5674
Pb LIV	PT	4867		EL	5342, 5494, 5965
Pb LXXIX	AT	5961		Hfs	5002, 5967A
		Bismuth		IP	5494
Bi I	CL	5196, 5507, 5909A		IS	4938
	EL	5196		PT	5763
	Hfs	4948, 5715, 5975A		W	5145
	IP	5196			

2.2. Reference Numbers for Individual Spectra—Continued

U II	AT CL Hfs IP PT W	5928 5145, 5471 5928 4919 5081 5145
U III	IP W	4919 5003, 5888
U IV	IP W	4919 5003, 5888
U V	AT CL EL IP PT	5129, 5729 5129 5129 4919 5129
U VI	IP	4919
U XXXII	AT	5235, 5621, 5891
U LXIV	PT	4867
U LXXXIX	AT	5961
Neptunium		
Np I	PT	5081
Np II	IP PT	4919 5081
Np III	IP	4919
Np IV	IP	4919
Np V	IP	4919
Np VI	IP	4919
Plutonium		
Pu I	CL EL PT	5798 5798 5081
Pu II	IP PT	4919 5081
Pu III	IP	4919
Pu IV	IP	4919
Pu V	IP	4919
Pu VI	IP	4919
Curium		
Cm I	IS PT W	4890 5081 4995
Cm II	ND PT W	5902A 5081 4995
Berkelium		
Bk I	EL PT	5113A 5081
Bk II	EL PT	5113A 5081
Californium		
Cf I	PT	5081
Cf II	PT	5081
Einsteinium		
Es I	PT	5081
Es II	PT	5081
Lawrencium		
Lr I	AT	5168

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S X, Mo XIV, Tc XV, Ru XVI, Rh XVII, Sn XXII: PT
Sb XXIII, Te XXIV, I XXV, Xe XXVI, Ta XLV: PT
W XLVI, Re XLVII, Os XLVIII, Ir XLIX, Pt L: PT
Au LI, Hg LII, Tl LIII, Pb LIV, U LXIV: PT
Y XI, Zr XII, Nb XIII, Pd XVIII, Ag XIX: EL PT
Cd XX, In XXI: EL PT
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